REMARKS

Claims 2-7 and 14-18 are all the claims pending in the application. By this Amendment, new claims 19-26 are added. For at least the reasons herein, Applicant respectfully requests withdrawal of the rejections and objections, and allowance of the claims.

Applicant thanks the Examiner for the courtesies extended during the personal interview conducted with Applicant's representatives. A separate Statement of Substance was provided for the record on September 15, 2003.

I. Objections to claims and drawings:

The Examiner objects to the drawings because the claimed conical nozzle body recited in claim 15 is allegedly not shown. At this time, solely to advance prosecution, Applicant has cancelled claim 15 without prejudice and/or disclaimer. As such, Applicant request that the objection to the drawings be withdrawn.

Further claims 5 and 14 have been amended to overcome the Examiner's objections. Thus, withdrawal of these objections is respectfully requested.

II. 35 U.S.C. § 112, 1st paragraph rejections:

Claims 2-7 and 14-18 stand rejected under 35 U.S.C. § 112, 1st paragraph, due to alleged lack of adequate written description. More specifically, the Examiner asserts that a specific minimum spacing should be required, and further, that a limitation on the number of mutually spaced separation triggering elements to produce the desired effect is also required. The Examiner also states that there are other factors associated with the three-dimensional separation

of flow, such that an undue burden would be placed on one skilled in the art to make and use the invention.

As shown in the foregoing amendments, Applicant has amended the claims in a manner that is believed to place them in proper condition. Additionally, Applicant respectfully submits the following arguments.

Applicant respectfully disagrees with the Examiner's position on the issues as discussed in greater detail below, and believes that sufficient written description has been provided for the claimed invention. Further, Applicant believes that the Examiner's requirements exceed the written description requirements under 35 U.S.C. § 112, 1st paragraph, and the supporting MPEP and case law.

Applicant notes that under MPEP § 2163, the fundamental inquiry is whether the specification provides reasonable clarity that applicant had possession of the invention (see also *Vas-Cath, Inc.*, 19 USPQ2d at 1117). With respect to other factors that the Examiner states may be present with respect to producing the three-dimensional separation of flow, Applicant notes that the presently claimed invention is only directed to spacing and location of the injection points, and that one skilled in the art would be able to vary these points without an unreasonable amount of experimentation. Further, the assertion that there may be other factors points to a general unpredictability in the art, which does not form an adequate basis for a written description requirement rejection under 35 U.S.C. § 112, 1st paragraph.

More specifically, as mentioned above, the Examiner asserts that, in view of Mueller:

1. To produce the desired effect, a minimum spacing should be required, as well as a limitation on the number of mutually spaced separation triggering elements.

2. There are also other features (such as the pressure of the injection fluid) that are associated with the three dimensional separation of flow, so that an undue burden would be placed on one skilled in the art to make and use the invention.

Applicant respectfully submits that one exemplary feature of the invention, as recited in amended claim 14 and new claim 20 is that a three-dimensionality of the separation of the flow is obtained when consecutive separation zones do not merge in the injection cross section. As shown in Figure 1, the separation triggering elements are independent in the sense that in the injection cross-section, the separation zones do not merge.

As explained in the description (page 8, line 31 to page 9, line 13 or paragraph [0052] of the corresponding published U.S. Application 2002/0157399) and as shown in Figure 1:

- upstream of the injection cross-section, the zones 6 of jet separation have an apex 9 located upstream of the injection cross-section and from which the zones 6 of jet separation widen.

- downstream of the injection cross-section, the widening zones 6 of jet separation overlap and merge to create a three-dimensional separation of the flow.

For this merging to occur only downstream of the injection cross-section, the zones 6 of jet separation, as shown in Figure 1, must not overlap in the injection cross-section. In the injection cross-section, the trace of the zones 6 of jet separation is an arc. If the traces of consecutive zones 6 overlap in the injection cross-section, the separation zones will be merged and a quasi-uniform separation ring will be created as in Mueller, rather than distinct zones of jet

separation as in the present invention. If two consecutive triggering elements (i.e. injection orifices 5) are spaced so that the traces of two consecutive zones 6 of jet separation do not overlap, i.e. that no two consecutive jet separation zones merge in the injection cross-section, distinct zones of jet separation will be produced.

As recited in the specification, page 9 lines 24 to 35 or paragraph [0054] of the corresponding published U.S. Application, the only condition to create a zone of flow separation from an injection orifice is to inject a sufficient flow rate through it. The minimum flow rate is the same as for the large number of orifices in Mueller. So, one of ordinary skill in the art would have known what flow rate is convenient for an injection orifice to obtain zones of flow separation - it is the same as in Mueller.

With a related art injection mass flow rate, as in Mueller, and by applying the teaching of the specification, one of ordinary skill in the art may determine either experimentally or by using computer simulated fluid dynamics, the shape of the zone of flow separation resulting from an injection through an isolated orifice, and the trace of this zone of separation in the injection cross-section. If, as claimed, two consecutive injection orifices are spaced so that the traces of each flow separation zone in the injection cross-section do not overlap, this trace will be the same as the trace of the flow separation zone of an isolated element in the injection cross-section. This is a one, basic concept of the invention - independent injection orifices generate distinct zones of jet separation. In the present invention, the triggering element serves only as a fixing point for the separation which otherwise would naturally occur downstream and would be unstable. These zones of jet separation remain independent until they merge downstream of the injection cross-section, to form a three-dimensional separation of the flow.

Accordingly, one of ordinary skill in the art has sufficient teaching to determine for a given rocket engine the minimum spacing (or which amounts to the same, the maximal number) of the triggering elements.

The shape of the zones 6 remains the same whatever the parietal injection conditions which are the same for each hole as in the related art Meuller injection ring.

The minimal spacing (or maximal number) need not be of particular interest for the invention, because the recommended configuration is the one which yields the desired effect with a minimal number of injection holes, whereas increasing the number of injection holes just increases the complexity and the injection flow rate as well as the mass of the rocket, to no benefit.

Applicant notes that there are no other specific rejections with respect to the dependent claims, and those dependent claims are thus believed to be allowable for at least the reasons discussed above. Accordingly, Applicant respectfully requests withdrawal of the 35 U.S.C. § 112, 1st paragraph rejections.

III. 35 U.S.C. § 112, 2nd paragraph rejections:

Claims 2-7 and 14-18 stand rejected due to alleged indefiniteness. The Examiner makes a general assertion that the claims are indefinite based on the alleged inadequate disclosure, and then makes a specific rejection of claim 14, lines 1 and 2 from the bottom. The latter point is addressed in the foregoing amendments. With respect to the former point, Applicant respectfully submits that there is no specificity to this rejection, and because it would thus appear to be a §

112, 2nd paragraph rejection that is based on § 112, 1st paragraph rejection, this grounds of rejection is improper and should be withdrawn.

Thus, Applicant respectfully submits that the claims are in proper condition, and the 35 U.S.C. § 112, 2nd paragraph rejection should be withdrawn.

IV. 35 U.S.C. § 102 rejections:

Claims 2-4, 6, 14 and 16-18 stand rejected under 35 U.S.C. § 102(b) over each of Mueller, Rannie, Abbott and Fitzgerald individually. Further, claims 5 and 7 stand rejected under § 102(b) over either of Mueller or Rannie individually, and claim 15 stands rejected under § 102(b) over Fitzgerald. Applicant respectfully submits that the references fail to anticipate all of the claimed combinations of features, as required for a § 102 rejection. For at least the reasons herein, Applicant respectfully requests withdrawal of these rejections, and allowance of the claims.

Independent claim 14

MUELLER

Figure 4 of Mueller illustrates a rocket engine that has a combustion chamber and a throat, as well as a divergent nozzle body. Further, there are mutually spaced separation triggering elements, and fluid can be simultaneously injected into those elements.

However, Applicant respectfully submits that Mueller does not disclose distinct zones of separation, or the spacing of elements to generate this distinct zone of separation, as recited in claim 14. Instead, the elements of Mueller are spaced as a "shock ring" so that instead of being distinct, the zones of separation form a single ring. This feature of Mueller and its benefits are

disclosed at column 3, line 53-column 4, line 54. Thus, Applicant respectfully submits that the structural relationship between the spacing of the elements and the separate distinct zones of jet separation is not disclosed. In fact, Mueller appears to teach just the opposite, in that the "shock ring" concept teaches away from keeping the zones distinct, but instead, teaches that the zones all significantly overlap.

Since the zones all significantly overlap, the single ring will be subject to a separation that is initiated at a random point that is unstable as explained in the present specification page 3 lines 32 to 38 (or paragraph [0021] of the corresponding published US Application).

RANNIE

Applicant respectfully submits that the purpose of Rannie is to stabilize an already naturally separated zone, because a natural separation is unstable and generates large fluctuating side loads (see column 2, lines 7 to 14). Rannie's idea is to feed enough fluid into the dead separated zone to stabilize it (see column 2, line 66 to column 3, line 10).

A naturally separated flow has one or more initiation points located at random across the whole perimeter of the nozzle, which are unstable in position. The massive injection of fluid as proposed by Rannie allows to cancel the recirculation which characterizes a natural separation zone (i.e. a counter-current low speed flow along the wall in the separated region, this flow turning back in the direction of the main stream and accelerating in the shear layer along the jet). The injected fluid feeds a separated area of downward flowing gas (with no counter flow) which has a low velocity and dynamic pressure. By suppressing the recirculation, the interaction between the forward flowing and downward flowing gas is cancelled, and one of the

intermediate elements playing a role in the instability is suppressed. However a device according to this principle only works when all the separated zones are entirely filled by down-flowing injected fluid, which is partly accelerated by the rocket jet in the shear layer. Since the flow separated spans across the whole nozzle, this requires a lot of injected fluid mass flow rate flowing through a large number of orifices located downstream of the place at which natural separation occurs.

Conversely, in the present invention, fluid injection through separation triggering elements (injection orifices) allows to trigger distinct zones of jet separation but no attempt is made to cancel the recirculation in the separated zones, and therefore the required mass flow rate is much smaller.

ABBOTT

The purpose of Abbott is thrust vector control, so that the thrust vector is no longer aligned with the nozzle axis, by creating shock control shock waves (see claim 1), whereas according to the present invention, a flow separation is obtained in a thrust that is essentially parallel to the nozzle axis.

FITZGERALD

Fitzgerald, like Abbott, also deals with thrust vector control. The nozzle includes sets of control ports (44, 46) for deflecting an exhaust plume to produce large and small side forces and also significant roll moments. It is not disclosed that a flow separation is obtained in a thrust that

is essentially parallel to the nozzle axis. Thus, Applicant respectfully submits that Fitzgerald fails to disclose all of the features recited in claim 14.

Dependent Claims:

Applicant respectfully submits that the dependent claims are allowable for at least the same reasons as the independent claims from which they depend. Additionally, Applicant respectfully submits that none of the cited art discloses an injection orifice that induces a distinct zone of separation, as recited in claim 2.

Further, Applicant respectfully submits that none of the cited art discloses that the injection cross section is arranged a distance D from the throat, which is less than the location of the spontaneous separation of the flow at sea level, as recited in claim 6, or the distributing device recited in claim 7, which takes into account variation of the distance of spontaneous separation of flow as a function of altitude.

Applicant respectfully submits that neither Mueller nor Rannie discloses either exactly two or exactly three mutually spaced separation triggering elements, as recited in claims 16 and 17, and three injection orifices positioned at 120 degrees with respect to each other as recited in claim 5.

Accordingly, Applicant respectfully requests withdrawal of the rejections, and allowance of the claims.

V. New Claims:

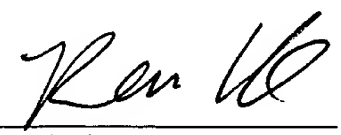
As shown in the foregoing amendments, Applicant has added new claims 19-26, which are believed to be in proper condition, and allowance over the art of record. Accordingly, Applicant respectfully requests allowance of these claims.

VI. Conclusion:

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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